

GEOLOGY OF THE CUB RUN QUADRANGLE, KENTUCKY

BY

WALLACE WOODROW HAGAN

B.S., University of Illinois, 1935

M.S., University of Illinois, 1936

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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LOCATION

The Cub Run quadrangle is located in western Kentucky between $86^{\circ} 00'$ and $86^{\circ} 15'$ west longitude and between $37^{\circ} 15'$ and $37^{\circ} 30'$ north latitude. It comprises an area of approximately 245 square miles and includes parts of Hardin, Grayson, Hart, and Edmonson counties, Kentucky. This report covers all this area with the exception of the Edmonson County part which was previously reported on by J. Marvin Weller in 1927.

MAPS

An areal geologic map and a structural geologic map, prepared from readings at some 1600 different locations which were recorded on the 1925 edition of the topographic map of Cub Run Quadrangle, accompany this report. The descriptive method of location of points used is known as the Carter Coordinate system.

PHYSIOGRAPHY

The Cub Run quadrangle is a part of the Shawnee and Highland Rim sections of the Interior Low Plateau. The quadrangle is divided into four topographic areas which were proposed for Edmonson County by J. Marvin Weller, namely,

- (1) Dripping Springs Escarpment
- (2) Interior Plains
- (3) Valley Sinks
- (4) Hilly Country

and a fifth subdivision is proposed by the author, namely,

- (5) Dissected Interior Plains

The maximum relief for the region is 500 feet, the maximum local relief is 400 feet, and relief of 200 to 300 feet is common. Elevations range from 460 to 960 feet above sea level. Drainage is predominantly to Nolin River with some to Green and Rough Rivers. Nolin River is an entrenched meandering stream which probably had its present course primarily determined on the Lexington or Highland Rim peneplain in Late Tertiary time. This peneplain is represented by the flat uplands on the higher ridges in the Hilly Country.

SUBSURFACE STRATIGRAPHY

Brief stratigraphic analyses were made of twenty-four logs included in the report. This study, together with a review of some of the works of Louise Freeman, Paris B. Stockdale, Reid P. Meacham, Charles Butts, and Shaw and Mather, indicates that probably rocks as old as the Cotter formation of the Beekmantown group of the Ordovician system may exist here, and that the drill had penetrated 302 feet below the Chattanooga black shale probably into the Silurian. In the Lower Mississippian of the Cub Run quadrangle, the New Albany black shale ranges from 68 to 123 feet thick. The New Providence formation in some wells is a green shale from 5 to 39 feet thick, and in one well it is a limey sandstone and green shale 44 feet thick. The Kenwood member of the New Providence formation may be represented by a thin sandstone.

The New Albany shale thickens from 105 feet at Dog Creek in Hart County to 120 feet at Meredith in Grayson County and thins to the north. The Osage and Meramec groups thin to the south from 1075 feet in the Carl Hazlewood well at Meredith to 997 feet in the Dog Creek wells and thickens to 1023 feet in the John Jagers well south of Cub Run. The delimitation of formations between the Cypress and base of the limestone section above the black or green shale is not feasible from these drillers logs. A sandstone 94 to 173 feet above the base of the Osage limestone may be the Holtsclaw sandstone of the Brodhead formation.

SURFACE STRATIGRAPHY

The surface strata of the Cub Run quadrangle belong in the Mississippian and Pennsylvanian systems and are commonly classified in descending order as follows:

Pennsylvanian system

Pottsville series

Tradewater formation

Caseyville formation

Bee Spring sandstone member

Drury member

Kyrock conglomerate member

Mississippian system

Chester series

Elvira group

Leitchfield formation

Homberg group

Glen Dean limestone

Hardinsburg sandstone

Golconda limestone

Cypress formation

New Design group

Paint Creek limestone

Sample formation

Renault limestone

} Girkin

Valmeyer series

Meramec group

Ste Genevieve limestone

The stratigraphy of these rocks presents several interesting problems. It is complicated by the Rough Creek fault zone and the Ste. Genevieve-Renault contact is difficult to determine since the Aux Vases sandstone is absent. The lowest member of the Renault formation which was called the "Unnamed" limestone by Stouder is correlated on faunal content with the Shetlerville of Illinois and probably with the Paoli of Indiana. The Mooretown sandstone member of the Renault and the Elwren sandstone of the Paint Creek are exposed at Spurrier, but disappear to the south, although the Mooretown is recognizable at Broad Ford. The Sample sandstone between the Renault and Paint Creek grades laterally into limestone to the west and south in the quadrangle. The Leitchfield formation is divided into eight members which are probably correlatives of the eight formations of the Elvira group in western Kentucky. Representative fossil lists and sections are included.

The Pennsylvanian strata overlap and succeed the Chester beds of the Mississippian with pronounced unconformity. A pre-Pennsylvanian river channel crosses the Winesap and Dog Creek rectangles from northeast to southwest and is filled with

as much as 235 feet of conglomeratic sandstone, the Kyrock conglomerate. The channel cuts into the Chester as low as the top of the Cypress sandstone in places.

STRUCTURAL GEOLOGY

The Cub Run quadrangle is located on the axis of the southeastern extension of the Western Kentucky Coal Basin, on the southwestern flank of the Cincinnati arch and north of the Nashville dome. The regional dip of the strata is to the southwest north of the syncline axis and to the northwest in the region south of the axis. The complex fault system which crosses the Cub Run quadrangle in a northwest-southeast direction is a part of the Shawneetown-Rough Creek fault zone which crosses the Southern Illinois and Western Kentucky Coal Basin in an east-west direction. A map of the structural geology of the Cub Run quadrangle accompanies this report. The map shows 53 faults, 65 oil and/or gas test well locations, and structural contours with an interval of 20 feet drawn on two datum surfaces. The datum used in the Millerstown rectangle is the top of the "*Productus*" *inflatus* limestone, and in the remainder of the area the base of the Golconda limestone. Some 1600 or more different elevations were used in preparation of the map. Elevations were taken with a hand level and locations were plotted on the topographic map as a base. Strike and dip readings were made with a Brunton compass, and the more important of these readings have been plotted on the map.

The faults have an en echelon arrangement with some of them diverging from the main zone. The throw of the strata along the faults varies from place to place from as little as 10 feet to as much as 160 feet. All the faults are normal except one small thrust with a displacement of 15 feet. Some are pivotal faults and others are hinge types. It is common for a small area in the vicinity of the junction of two faults to fracture along several small faults. The fault planes are predominantly at high angles. The zone of influence of any one fault on the angle of dip of nearby strata is limited to a narrow belt about one-half a mile or less in width, parallelling the trend of the fault. There seems to be no relationship between the vertical component of

displacement or throw of these faults and the angle of dip of strata adjacent to them.

The faults in the Cub Run quadrangle were formed predominantly in post-Pottsville time. Fault No. 26 and the Iberia fault, although subjected to post-Pennsylvanian movement also suffered pre-Pottsville-post-Chester deformation. The fault south of Sims Ford indicates a similar pre-Pottsville faulting.

Evidence of pre-Pennsylvanian tilting is indicated by the Chester arch near Meredith and the angular relationship between the Pennsylvanian and Chester beds.

The faults considerably modify the regional dip in various portions of the quadrangle and has been instrumental in the development of several small anticlines, synclines, basins, noses, and domes, some of which have been named.

ECONOMIC GEOLOGY

The Cub Run quadrangle contains some resources of economic value such as rock asphalt, "marl", coal, limestone, and possibly oil and gas reserves under untested structures. Results of some ignition tests on asphaltic sandstones, core test hole records for asphalt, and the conclusions from these results are included. Areas which may yet attain commercial importance for asphalt are: (1) the Meredith area between Fowler's Meredith quarry and the C. J. Huffman farm, (2) the Oscar Constant and Claude Constant farms on the east side of Conoloway Creek on the ridge top about one-half mile west of Oklahoma School, and (3) an area on the Claude Constant farm west of Fowler's quarry and one-half mile west of St. James Church. The asphalt in these areas is in the Pottsville.

The best marl zones occur at the top of the Glen Dean massive limestone, and in the shale at the top of the Vienna limestone. Coal is only locally commercial.

Sixty-five oil and gas test holes have been drilled in the quadrangle since the early 1860's. None of these were commercial holes although most of the wells penetrated the Devonian and Silurian strata. There are yet some untested structures in the area.

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VITA

Wallace Woodrow Hagan was born at Griggsville, Illinois, on February 3, 1913. After being graduated from Urbana High School, Urbana, Illinois, he attended the University of Illinois where he received the degrees of Bachelor of Science in Geology with High Honors in the year 1935, and Master of Science in Geology in 1936. He was awarded a University of Illinois scholarship for graduate study in the school years 1935-1936, and fellowships for the years 1936-1937 and 1940-1941. In the summer of 1935 he was Student Geological Technician for Mesa Verde National Park, Colorado. He was an assistant to Dr. Harold R. Wanless under a Geological Society of America grant in the summer of 1936.

From September, 1937 to June, 1939 he was assistant to the Chief Geologist of the J. V. Wicklund Development Company of Detroit, Michigan. He was a consulting petroleum geologist from June, 1939 to September, 1940.

He is a member of Sigma Xi, Phi Kappa Phi, Phi Beta Kappa, American Association for the Advancement of Science, Paleontological Society, and Associate Member of the American Association of Petroleum Geologists.

He is a co-author with A. H. Sutton, Department of Geology, University of Illinois, of "Inadunate Crinoids of the Mississippian-*Zeacrinus*", *Journal of Paleontology*, vol. 13, no. 1, pp. 82-96, 1939.

